

WHAT IS CLAIMED IS:

1. A digital-watermark embedding method comprising:
  - a generating step of generating digital-watermark information;
  - an input step of inputting an image;
  - a setting step of setting a first parameter determining robustness to attack on the digital-watermark information embedded in the image and a second parameter determining quality of the image in which the digital-watermark information is embedded;
  - an embedding step of embedding the digital-watermark information in the input image by using the first and second parameters;
  - a determination step of determining whether or not the entire digital-watermark information can be embedded in the image;
  - an update step of updating one of the parameters so as to embed a larger amount of digital-watermark information in the image when it is determined that the entire digital-watermark information cannot be embedded in the determination step, the update step being performed as a first stage; and
  - an embedding step of embedding the digital-watermark information in the input image again by using the updated

parameter,

wherein the determination step is performed for each of the embedding steps.

2. A method according to Claim 1, further comprising:  
an update step of updating the second parameter so as to degrade the image quality when it is determined that the entire digital-watermark information cannot be embedded in the determination step, the update step being performed as a first stage; and

an embedding step of embedding the digital-watermark information in the input image again by using the first parameter and the updated second parameter.

3. A method according to Claim 2, further comprising:  
an update step of updating the first parameter so as to degrade the robustness when it is determined that the entire digital-watermark information cannot be embedded in the determination step and when the degradation of the image quality reaches a first threshold value, the update step being performed as a second stage; and

an embedding step of embedding the digital-watermark information in the input image again by using the updated first parameter and the second parameter.

4. A method according to Claim 3, further comprising:  
an update step of updating the second parameter so as to degrade the image quality when it is determined that the entire digital-watermark information cannot be embedded in the determination step, when the degradation of the image quality reaches the first threshold value, and when the degradation of the robustness reaches a first threshold value, the update step being performed as a third stage; and  
an embedding step of embedding the digital-watermark information in the input image again by using the first parameter and the updated second parameter.

5. A method according to Claim 1, further comprising:  
an update step of updating the first parameter so as to degrade the robustness when it is determined that the entire digital-watermark information cannot be embedded in the determination step, the update step being performed as a first stage; and

an embedding step of embedding the digital-watermark information in the input image again by using the updated first parameter and the second parameter.

6. A method according to Claim 5, further comprising:  
an update step of updating the second parameter so as to degrade the image quality when it is determined that the

entire digital-watermark information cannot be embedded in the determination step and when the degradation of the robustness reaches a first threshold value, the update step being performed as a second stage; and

an embedding step of embedding the digital-watermark information in the input image again by using the first parameter and the updated second parameter.

7. A method according to Claim 6, further comprising:

an update step of updating the first parameter so as to degrade the robustness when it is determined that the entire digital-watermark information cannot be embedded in the determination step, when the degradation of the robustness reaches the first threshold value, and when the degradation of the image quality reaches a first threshold value, the update step being performed as a third stage; and

an embedding step of embedding the digital-watermark information in the input image again by using the updated first parameter and the second parameter.

8. A method according to Claim 1, wherein a plurality of letters are included in the image, and, in the embedding step, the digital-watermark information is embedded in the image by rotating the letters so as to change the inclination angle of the letters.

9. A method according to Claim 8, wherein the second parameter specifies the range of rotation angle of the letters.

10. A method according to Claim 8, wherein the first parameter specifies the repetition number of embedding the digital-watermark information in the image.

11. A method according to Claim 8, wherein the digital-watermark information is encoded with an error-correction code, and the first parameter specifies the error-correction ability of the encoded digital-watermark information.

12. A method according to Claim 1, wherein a plurality of letters are included in the image, and, in the embedding step, the digital-watermark information is embedded in the image by changing the positions of the letters so as to adjust spaces between the letters.

13. A method according to Claim 12, wherein the second parameter specifies the range of movement of the letters.

14. A method according to Claim 12, wherein the first

parameter specifies the repetition number of embedding the digital-watermark information in the image.

15. A method according to Claim 12, wherein the digital-watermark information is encoded with an error-correction code, and the first parameter specifies the error-correction ability of the encoded digital-watermark information.

16. A method according to Claim 1, wherein the both parameters are updated so as to embed a larger amount of digital-watermark information in the image when it is determined that the entire digital-watermark information cannot be embedded in the determination step, the update step being performed as a first stage.

17. A digital-watermark embedding device comprising:  
a generator for generating digital-watermark information;  
an input unit for inputting an image;  
a setting unit for setting a first parameter determining robustness to attack on the digital-watermark information embedded in the image and a second parameter determining quality of the image in which the digital-watermark information is embedded;

an embedding unit for embedding the digital-watermark information in the input image by using the first and second parameters;

a determination unit for determining whether or not the entire digital-watermark information can be embedded in the image; and

an update unit for updating one of the parameters so as to embed a larger amount of digital-watermark information in the image when the determination unit determines that the entire digital-watermark information cannot be embedded, the update being performed as a first stage,

wherein the embedding unit embeds the digital-watermark information in the input image again by using the updated parameter, and

the determination unit performs determination every time embedding is performed.

18. A storage medium storing a digital-watermark embedding program, the program comprising:

a generating step of generating digital-watermark information;

an input step of inputting an image;

a setting step of setting a first parameter determining robustness to attack on the digital-watermark information embedded in the image and a second parameter determining

quality of the image in which the digital-watermark information is embedded;

an embedding step of embedding the digital-watermark information in the input image by using the first and second parameters;

a determination step of determining whether or not the entire digital-watermark information can be embedded in the image;

an update step of updating one of the parameters so as to embed a larger amount of digital-watermark information in the image when it is determined that the entire digital-watermark information cannot be embedded in the determination step, the update step being performed as a first stage; and

an embedding step of embedding the digital-watermark information in the input image again by using the updated parameter,

wherein the determination step is performed for each of the embedding steps.